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HARMFUL PLANTS

A vintage black and white photograph of a small, single-story house with a chimney, surrounded by trees. In the foreground, a young girl in a light dress stands on the left, and a large, dark bush is on the right. A sign is posted in the bush that reads: "THIS IS THE HARMFUL COMMON BARBERRY AT SEABOARD BLACK BEACH RESORT. NOTE: 1. Berries are Red-Green. 2. Berry never Lones. 3. Berries with three spines. 4. Only Blue Bark. 5. Also have Red & Purple. REPORT BUSHES".

Every pupil in this school has learned to identify Common Barberry bushes and is helping to eradicate them from his home community.

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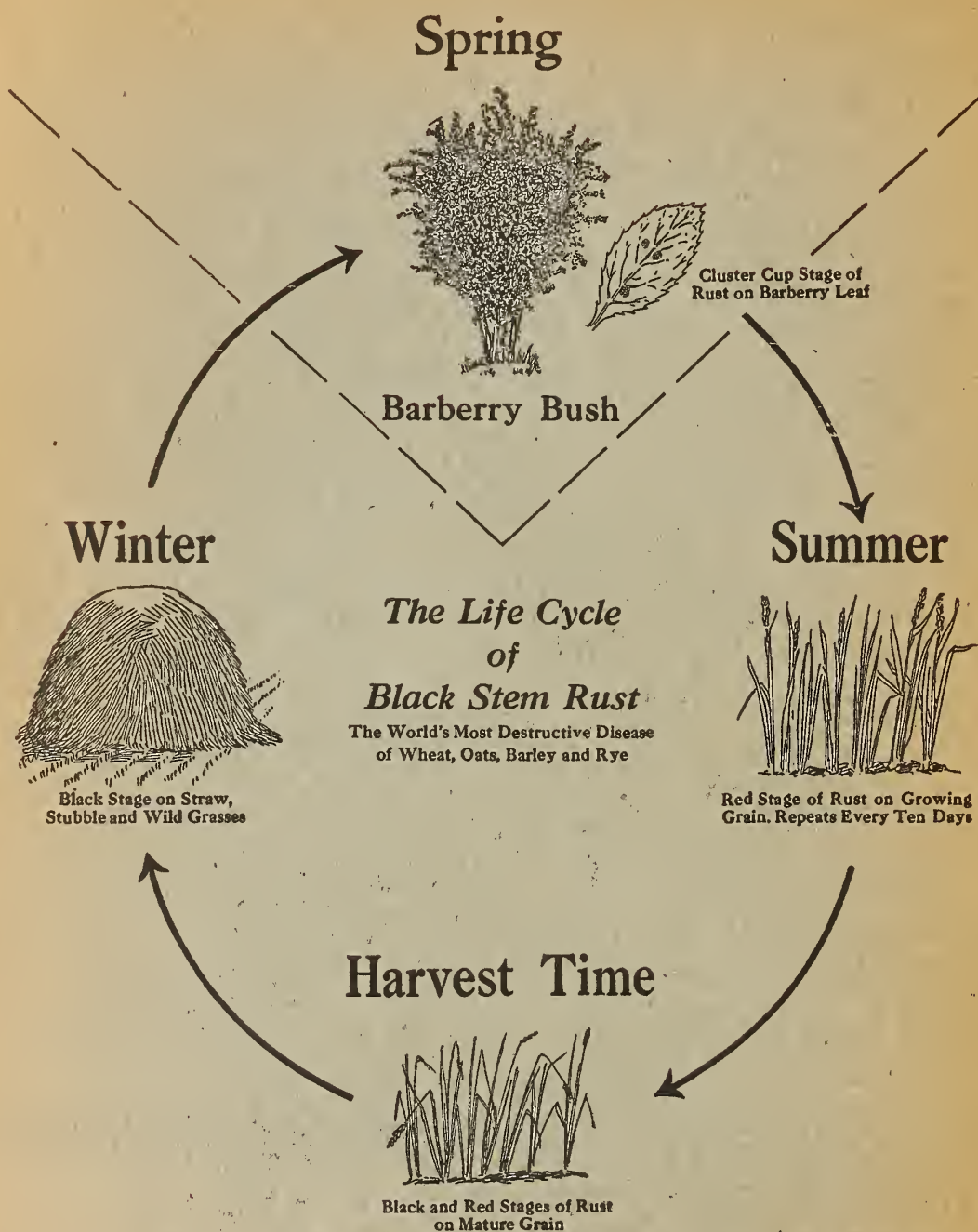
Lesson Plan Series
HARMFUL PLANTS

The Common Barberry and Black Stem Rust



Every pupil in this school has learned to identify Common Barberry bushes
and is helping to eradicate them from his home community.

Remove the Barberry and Break the Rust Cycle



All Common Barberries act as starting points for Black Stem Rust early each spring. By destroying the barberry the early spring source of black stem rust is eliminated. The Common Barberry provides a means to bridge the gap between the black stage on grain in the fall and the red stage of the rust on grains and grasses the following spring.

BOOST BARBERRY ERADICATION—A PRACTICAL RUST CONTROL MEASURE

UNITED STATES DEPARTMENT OF AGRICULTURE
BUREAU OF PLANT INDUSTRY

LESSON PLAN SERIES FOR
INTERMEDIATE GRADES AND JUNIOR HIGH SCHOOL

HARMFUL PLANTS

The Common Barberry Bush and Black Stem Rust

By Catherine M. Conoboy, Supervisor of Intermediate Grades, State Teachers College, LaCrosse, Wisconsin, and Donald G. Fletcher, Collaborator, Division of Barberry Eradication.

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INTRODUCTION

Harmful plants constitute a group in the plant kingdom which, although very important, up to the present time have received little attention from the boys and girls of the intermediate grades and junior high schools.

Many of the harmful plants that grow in nearly every community in this country have a decided effect upon the life of each of us. Millions of dollars worth of property and food products are destroyed by these plants every year, and the effects upon the economic conditions of our country are so great that the several States and Federal Government are spending huge sums in an effort to destroy them.

Some of these harmful plants are very tiny; and, because of their appearance and the way in which they live, they are called "fungi." Such plants have no leaves and can not manufacture their own food. For this reason they attach themselves to other growing plants and steal food from them. Such tiny fungous plants are called "parasitic fungi."

Some fungi attack dead plants and obtain all of their food from them, but such fungi are usually of great assistance to man in reducing dead and fallen trees and the remains of annual plants to dust. If it were not for these fungi and the bacteria that live on dead plants our forests, roadsides, and fields would soon become so filled with dry, unrotted material that nothing would grow.

There are many different kinds of rusts that attack our crop plants. These rusts and such other diseases of grain as smut, the root rots, bacterial spot, ergot, and black chaff, are very sensitive to weather conditions. Some years they cause widespread epidemics and enormous losses, while in other years these diseases are very scarce. Certain varieties of wheat, oats, and other crop plants are more resistant to disease than others, and when these varieties are desirable for market purposes farmers should plant them to avoid losses.

In order that every boy and girl may know something of these harmful plants that cause so much damage, it is essential that they be encouraged to investigate the life history of at least one typical and outstanding example of the group.

Black stem rust, a disease that attacks wheat, oats, barley, and rye, is caused by a tiny parasitic plant belonging to one of the lower orders of the plant kingdom. It has been used for years as a classical example of a plant disease caused by a parasitic plant. Its life history is so closely bound up with another injurious plant (the common barberry bush) that a study of both these plants will give the pupil an excellent opportunity to understand the group as a whole.

When studying harmful plants in any of the Northern States, it is particularly fitting that black stem rust be used as a typical example. Small grains are among the chief crops grown in the United States and upon their profitable production depends to a large extent the prosperity of our people. The damage to the wheat crop in a single year because of the prevalence of black stem rust has been estimated to be 180,000,000 bushels.

SUGGESTED INTRODUCTION

Since it is very important that each pupil make this his own problem rather than an exercise which has been selected and planned by the teacher, the initial stages or what is usually called the Introduction or Preparation, represent the most crucial phases of the whole campaign. There are many different ways to get the subject before the pupil in the form of a problem. The list given is merely suggestive and not complete in any sense.

1. Comment on an article in a newspaper or farm periodical about rust. Many articles regarding black stem rust losses are printed in the local newspapers every year.
2. Home experience with black stem rust.
3. Comparison of pictures of fields of good wheat and rusted wheat.
4. A study of the factors, good and bad, that affect crops.
5. The development of a social science project in interdependence.
6. A study of human life.
7. A discussion of air currents as transmitters of plant spores.
8. Comments on a poster showing disease losses to small grains.

MAJOR OBJECTIVE

To acquaint the pupil with harmful plants through the study of black stem rust and its relation to the common barberry bush.

SPECIFIC OBJECTIVES

1. To acquaint the pupil with the relation of the common barberry to black stem rust.
2. To realize the economic importance of the losses caused by black stem rust.
3. To develop the ability to identify the common barberry.
4. To acquire a knowledge of the history of the introduction and distribution of the common barberry in the United States.
5. To arouse an interest in the eradication of the common barberry bush.

SUGGESTED ACTIVITIES

1. Make posters showing:
 - a. A field before and after injury by rust.
 - b. Stages in the life cycle of rust.
 - c. Barberry plants (common and Japanese).
 - d. Plump and shriveled grain.
 - e. Slogans to encourage the control of rust.
2. Visit a flour mill.
3. Prepare exhibit materials.
4. Plan a program where barberry is discussed.
5. Arrange for a talk by the county agent.
6. Observe a live barberry, if possible.
7. Look for rust on growing grain, grasses, or straw in straw piles.
8. Have an exhibit with illustrated talks.
9. Read about the introduction of the barberry into the United States.
10. Find statistics on the amount of loss caused by rust:
 - a. In your State.
 - b. In the United States.
11. Draw a map of the United States indicating the great wheat areas of this country.
12. Locate on this map the area most affected by black stem rust.
13. Write an invitation to the county agent to speak at a special program.

14. Write an invitation to parents to come to a special program on black stem rust.
15. Make graphs in arithmetic showing losses each year from rust.
16. Organize hikes to hunt for common barberry bushes.
17. Organize a campaign to fight the common barberry.

DESIRED OUTCOMES

1. Direct:
 - a. An understanding of how harmful plants affect our lives and welfare.
 - b. A realization of the amount of damage done by black stem rust.
2. Indirect:
 - a. Ability to recognize common barberry.
 - b. Desire to help the country control black stem rust by locating and reporting all common barberry bushes to the proper Government authorities so that these bushes may be destroyed.

LESSON PLANS

LESSON I

Aim: To acquaint the pupil with the economic importance of losses from different causes to wheat, oats, barley, and rye, resulting in smaller production and in much poorer quality some years than other years.

Introduction: In our study of the Northern States, drained as they are by the Mississippi River and its tributaries, we found that small grains were grown everywhere and were often the farmers' principal crops. The teacher should point out this region on a wall map placed before the class. What were the chief wheat-producing States of this region? The chief oat-producing States? Where does our State rank in the production of these grains? Again refer to map. Ask some pupil to step to the map and point to the States, naming them. Those at their seats are asked to see whether the pupil at the map is answering correctly. We found that in 1915 the production of wheat in Minnesota was about 70,000,000 bushels, but in 1916 it dropped to 28,000,000

bushels, much of which was of poor quality. Teacher should write on board, "70,000,000 in 1915" and just below these figures "28,000,000 in 1916." This will help pupils to visualize the problem. What effect would that have upon the State of Minnesota? Keep in mind the fact that poor quality products are discounted when shipped to market. How would the farmers suffer from such a small production? Does it cost any less to produce poor crops than good ones? Would you like to find out one of the big causes why some years your father has good grain crops and some years poor? Would you like to help all the fathers in your community to have better grain crops? What might be some of the causes for poor crops? As you give me the causes I will write them on the board.

Procedure: Whether pupils will give possible causes readily will depend on their past training, the way they have been treated in class, the content of other courses, their home environment, and general reading interests. With some classes the teacher can expect a list of causes to be suggested somewhat similar to the following:

- 1 Lack of rain.
2. Wind storms.
3. Hail.
4. Early frosts.
5. Diseases.
6. Insects.

In case pupils are not familiar with making lists in this manner such questions as these may be asked to bring out the topics desired:

1. Have you ever seen fields of grain that appeared dried and scorched? What causes this? - To bring out No. 1 on the list.
2. In the spring farmers often have to plant their crops a second time, especially on prairie lands. Why would they have to do this? - To bring out No. 2 on the list.
3. Why do so many farmers take out hail insurance? Is that a cause for poor crops? - To bring out No. 3 on the list.

4. Have you ever heard people say, This flour was made from frozen wheat? When was it frozen, before or after harvest? Does it make as good flour as wheat that has not been frozen? Would this be a cause for poor crops? - To bring out No. 4 on the list.
5. Do plants ever get sick like people? What causes plants to become sick? Why do farmers sometimes treat their seed with chemicals before planting? - To bring out No. 5 on the list.
6. Why are grasshoppers looked upon as such an enemy to farmers? Would they ever cause a poor crop? What other insects besides grasshoppers destroy crops? - To bring out No. 6 on the list.

Each of the factors listed will be discussed to show how they cause poor crops. If the pupils give a list readily, the discussion of each one will take place after the list is completed. In case the teacher is compelled to stimulate the pupils through her questions, in all probability each topic will be discussed as thoroughly as would be expected by the time it is secured from the pupils. A detailed consideration of any one of the topics at this time is out of place. The teacher, however, must be prepared to furnish information concerning the different topics in case the pupils know very little about them.

In discussing each topic with the pupils after the list of causes has been selected and organized in the proper order, as determined by the judgment of the pupils, such questions as these may be asked: How would lack of rain cause poor crops? At what time of the year would wind storms do the most damage? Why? How does hail destroy crops? What would early frosts do to the kernels of wheat? How do insects destroy crops? What causes diseases on grain crops? Can you name some of these diseases? What harm do these diseases do to crops?

Assignment: Where could we find out which one of the causes listed does the most damage to small grains? Let the pupils suggest first, and then the teacher will add names of books and pamphlets that she knows. A final list suggested by pupils and teacher will include the following:

1. World Book.
2. Compton's Pictured Encyclopedia.
3. Book of Knowledge.
4. Other encyclopedias frequently found in schools.

5. Biology and botany textbooks.
6. Agriculture textbooks.
7. Pamphlets obtained from the United States and State Departments of Agriculture.
8. United States Department of Agriculture Yearbook.

The exact books or pamphlets used will depend on the materials available. Consult the county superintendent of schools, county agent, public libraries, library of the State Agricultural College, Department of Agriculture at Washington, D. C., etc. All material should be available before the study of the barberry commences.

In these books or pamphlets look in the index under the heading of "Wheat" or "Grain." When you locate a sub-topic called "Enemies of Wheat," or "Diseases of Grains," look up that topic and see what it tells you. For tomorrow look in these books and see what you find about enemies of grain crops. See if it tells you which one does the most damage.

LESSON 2

Aim: To acquaint the pupil with the fact that black stem rust causes the greatest damage to grain crops and especially to wheat.

Introduction: From the list of causes for poor grain crops which one did you find does the most damage? Black stem rust will be the answer. What is it like? Have you ever seen a wheat plant with black stem rust on it? Here, show the class one of the samples of rusted grain. If there is a straw stack or grain stubble field near your home, see if you can find some straw with black stem rust on it and bring it to school. Where does the rust come from? How can the barberry plant cause rust on wheat? In case pupils can not answer this ask, Where could we find out? If we wished to find out all about the barberry plant and how it causes rust, what facts would we have to know?

Procedure: Let us make a list of these things. The list given by the pupils will be placed on the board. Such questions as these may be asked to bring out the important facts about the barberry. Why is it important that we should be able to tell a barberry plant when we see it? Would this be a good topic for us to look up?

How shall we make a topic of this? This will bring out a topic such as What kind of a plant is it?

Is the common barberry found in all parts of the United States? Would it be important for us to find out where it grows? How would we word this topic? Where does it grow?

Does the barberry bush cause rust on grain plants? Could we find out how rust forms on the grain? How could we say that to make a good topic? How the barberry produces and spreads rust.

What time of the year do we find rust on crops? Would that be interesting to find out? How could we list that? What time of the year does stem rust cause damage?

Do you think other countries have rust? If they had barberry plants, how could they get to this country? Would we need to know this to make our story of the barberry plant complete? How could we make that into a topic? How the barberry came to the United States.

Before people found out that the barberry bush was harmful what use was made of it? Would you like to find out if the barberry has any uses? Is the barberry of any use?

What do you think people do to destroy the barberry? Would that be an important thing for us to find out? How common barberry bushes are destroyed.

If we were to make a connected story of this, which topic would come first? Let us put them in the order in which we think they should come. Such an order as this will probably be suggested:

1. What kind of a plant is the common barberry?
2. How common barberry came to the United States.
3. Where common barberry grows.
4. How the common barberry spreads rust.
5. What time of the year does black stem rust cause damage?
6. How rust injures grain crops.
7. Is the common barberry of any use?
8. How can we get rid of the common barberry and reduce grain losses caused by rust.

BLACK STEM RUST SPREADS FROM COMMON BARBERRIES



to Wheat, Oats, Barley, Rye and other Grasses.

Black Stem Rust as it appears on the leaves of the Common Barberry



Enlarged single leaf



Plump healthy grain



Shriveled rusted grain

DANGEROUS NEIGHBORS

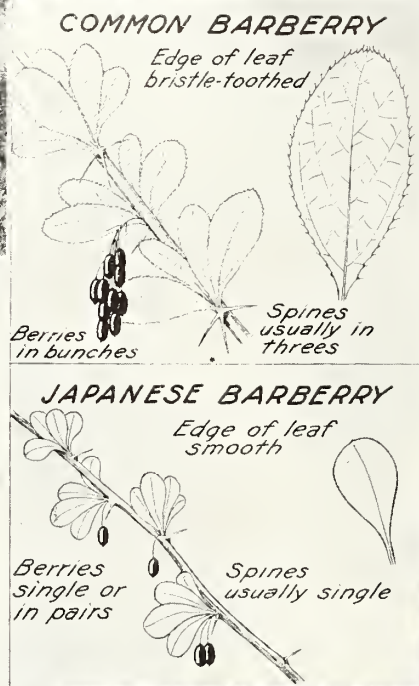


Common Barberry Bushes growing near grain fields

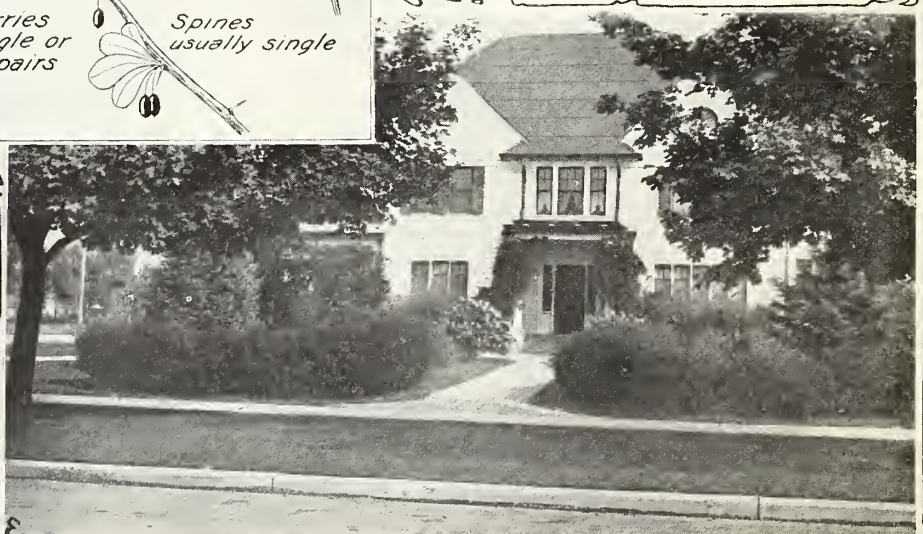
Report Common Barberry bushes you may find to your local Leader of Barberry Eradication.



Common Barberry is harmful, destroy



Japanese Barberry is harmless, do not destroy



Where can we find material for our topics? Pupils will suggest, teacher will add to the list. Here are some of the places you can find information about the common barberry plant and black stem rust. Encyclopedias, Pamphlets sent out by Department of Agriculture, Agricultural textbooks, County agent.

Assignment: Now you may choose the topics for which you wish to be held responsible to explain to the rest of the class. Who wants to find out the kind of a plant the barberry is? Write after the topic the name of the pupil or pupils who volunteer. In case there are no volunteers pass to the next topic. The first topic may be one that no one cares to take; the pupils may be reticent about being the first to volunteer. In case there are no volunteers, tell them they are to pick the one topic in which they are most interested. In this case the teacher might ask them in turn which topic they have selected. When a pupil names his topic, write his or her name after the topic. More than one person may take the same topic. Either of these procedures should be used until all topics have been taken and until every pupil has chosen a topic. If there is some topic that no one volunteers to take, assign it to some one who has not chosen one. Tell him that you will help him get material on it.

At the conclusion of this lesson, then, the topics will appear written on the board in the order the class decided they should come. After each topic there will be one or more names of pupils who have expressed a willingness to study that particular topic and report to the class later. The number of pupils for each topic will depend on the importance of the topic, the amount of material on that topic, and the size of the class. The teacher can help the pupils find material that applies to their particular topics during available study periods.

Tomorrow (or the next recitation period for this subject) we will discuss the first three of our eight topics:

1. What kind of a plant is the common barberry?
2. How common barberry came to the United States.
3. Where common barberry grows?

LESSON 3

Aim: To acquaint the pupil with the barberry plant, its introduction into this country, and where it is found in the United States.

Introduction: We have already found out that rust causes more damage to small grain, and especially wheat, than any other single disease. Today we shall begin our story of the barberry plant.

Procedure: The first pupil gives his talk. When he has finished, the others choosing the same topic will give any additions. Other members of the class can add any information on the subject they wish. They may also ask questions of the pupils reporting. If board space permits, write these facts on the board. Leave them there until next day. The following facts should be brought out in topic 1, Common and Japanese Barberry.

1. The size and height of common and Japanese barberry bushes.
2. Shape and color of leaves.
3. Color of bark.
4. Berries and how clustered.
5. Thorns and where found.
6. Common barberry is harmful, Japanese is not.

If these facts are not brought out by the pupils the teacher should supply them. The same procedure will be used for the other two talks. The following facts should be brought out in topic 2: How common barberry came to the United States.

1. Not a native of the United States.
2. Brought to America by colonists.
3. Brought westward by pioneers who first settled the country.
4. Introduced because of its uses.

In topic 3, Where common barberry grows, these facts should be brought out:

1. Found in all parts of the United States where grains are grown.
2. Often found near grain fields.
3. Found in deserted nurseries, cemeteries, shrubbery plantings around houses, etc.
4. Grows in pastures, woodlots, fence rows, along lake shores and streams, rocky hillsides, in fact, anywhere a bush can grow

5. Grows in Asia and European countries, although many countries are eradicating them just as we are.

A summary of the important facts should be made at the end of the lesson. Such questions as these should be asked: How would we be able to recognize a common barberry plant if we saw one? How could we distinguish it from a Japanese barberry? Why did the colonists bring it to the United States? Where would we look for common barberry plants if we should start a local campaign against them?

Here, if possible, make a field trip to some actual bushes. If feasible, have the county agriculturist direct this trip. If a field trip is impossible, bring a plant of common barberry and one of Japanese barberry to class.

Assignment: For tomorrow we will find out how the barberry spreads rust; the time of year rust does the most damage; and how rust injures grain crops. These are our 4th, 5th, and 6th topics.

LESSON 4

Aim: To acquaint the pupil with the relation of the barberry bush to black stem rust; how it injures grain crops; and the time of year it causes the most damage.

Introduction: From your talks yesterday we found that the common barberry is harmful, while the Japanese is not. You told us how to tell them apart. Who is ready to tell us the difference now? The teacher should expect to see all hands raised. In case some pupils are not sure whether they can tell, call on them first. Get from those pupils all the facts possible and then get the remaining facts from the rest of the class. Who can tell us why the barberry was brought to this country?

Before we hear the reports today, I want you to see what I have in my hand. It is a puffball such as you have no doubt seen in the fields. When you step on one a black or yellow powder flies out. Watch when I break

this one open. See the powder flying out. If we could look at some of this powder under a powerful magnifying glass we would find it to be very interesting. It is really not a powder, but a mass of tiny spores. (Write "spores" on the board.) Many plants have seeds for making other plants like themselves, but some plants, such as toadstools and ferns have spores instead of seeds. Spores are so very tiny that you can not see them clearly without a microscope. Now let us continue our study and find out how the barberry causes rust on the grains.

Procedure: The same procedure will be followed as in Lesson 3, having the assigned pupils report on the topics 4, 5, and 6. The following facts should be brought out in topic 4: How the common barberry spreads rust.

1. The four stages of rust.
2. Begins in early spring when black or winter spores germinate and each produces four tiny colorless spores.
3. These tiny colorless spores can grow and cause rust only on the common barberry bush.
4. Rust cluster-cups in yellowish or orange spots appear on the underside of the barberry leaves.
5. The cluster-cup spores carried by the wind cause the red stage of rust only on grains and grasses.
6. Red spores carried long distances by wind. These develop more rapidly in hot, muggy weather.
7. Red spores infect only grain and grass plants, not the barberry.
8. Many crops of red spores are produced during summer.
9. Black spores produced with red spores on grain and grass plants in fall live through the following winter and upon germination can infect only barberry bushes, not grain plants.
10. New forms of rust are produced on the common barberry. To protect the new and better varieties of grain now being developed, barberry bushes must be destroyed.

For topic 5 these facts should be brought out: What time of the year does black stem rust cause damage?

1. While the grain is still green.
2. While weather is warm.

These facts should be emphasized in topic 6: How rust injures grain crops.

1. Rust is harmful to wheat, oats, barley, rye, and many wild and tame grass plants.
2. Rust greatly reduces yield.
3. The grain kernels of plants attacked by black stem rust are shrunk and of lower milling and food value than plump disease-free kernels.
4. Farmers always receive less for rust-shriveled grain.

A summary of important facts discussed in the day's lesson will be made. This may be done by placing on the board the four stages of rust. (1) Tiny colorless spores. (2) Yellow cluster-cup or spring stage. (3) Red or summer stage. (4) Black or winter stage. Have pupils tell which stage infects the grain and which infects the barberry. Number 1, of course, infects only common barberry, while Numbers 2 and 3 infect grains.

Assignment: We have found out the harm the barberry plant does. Tomorrow we shall see if it is of any use at all. We shall find out what can be done to destroy it. These are our last two topics.

LESSON 5

Aim: To acquaint the pupil with the uses of the barberry plant and how it is eradicated.

Introduction: Yesterday we found out the harm the common barberry bush can do. Today we shall see if it does any good. Think, as this talk is given, to see whether it does as much good as harm.

Procedure: For topic 7 the following facts should be brought out: Is the common barberry of any use?

1. The common barberry always has been used as an ornamental shrub around houses.
2. Used as dyes and inks.
3. Used as hedges to separate fields, thus bringing the bush near wheat fields.
4. Farmers soon found that wheat from fields near these hedges was not so good as that from fields farther away.
5. The stems were used for implements.
6. Leaves used as salads.
7. Berries for jelly.

In the same manner these facts should be brought out for topic 8. How the common barberry is being destroyed and other methods of reducing rust losses. How can we get rid of the common barberry and reduce grain losses caused by rust?

1. Salt placed around roots - best way to kill bushes.
2. Kerosene poured around roots kills the bush.
3. Thorough digging of barberry bush is necessary when bush is growing close to valuable shrubbery that might be killed if barberry were treated with chemicals.
4. Early planting of grain crops often allows them to ripen before the rust can do much damage.
5. Planting rust-resistant varieties reduces losses.
6. Federal and State Agricultural campaigns are conducted to find and destroy all common barberry bushes.

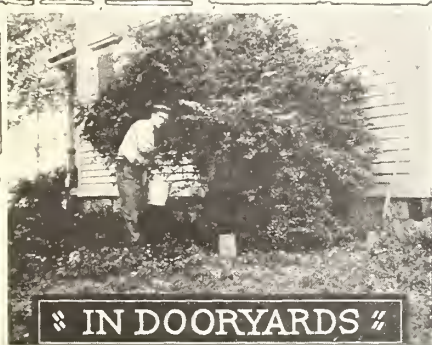
The remainder of this period can be spent in a general review of the entire series of lessons on the common barberry. The teacher may ask questions of the pupils, the pupils may ask questions of other members of the class, or they may divide into groups of two's and ask each other questions. This review is in preparation for the final test to be given the next day.



FLOWERS
(yellow)

BERRIES
(bright red)

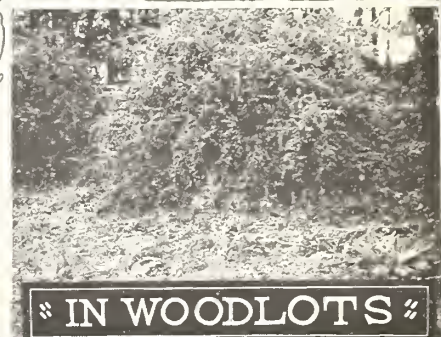
Where Barberry Bushes Grow



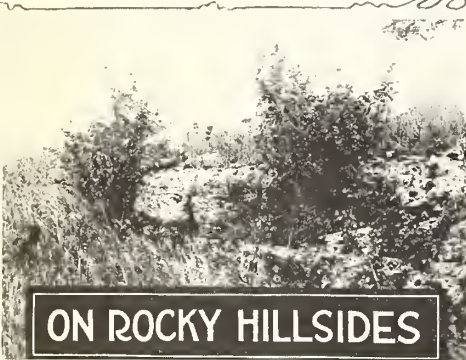
IN DOORYARDS



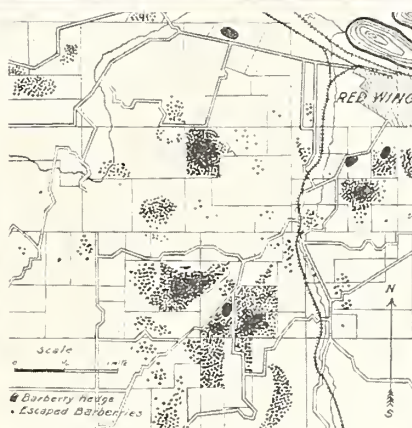
BIRDS CARRY BARBERRY SEEDS SEVERAL MILES, DROPPING THEM AMONG ROCKS AND IN OUT-OF-THE-WAY PLACES



IN WOODLOTS



ON ROCKY HILLSIDES



AS HEDGE FENCES

Barberries spread by birds



UNDER OTHER
SHRUBS and TREES



COMMON SALT KILLS BARBERRY BUSHES AND PREVENTS SPROUTING



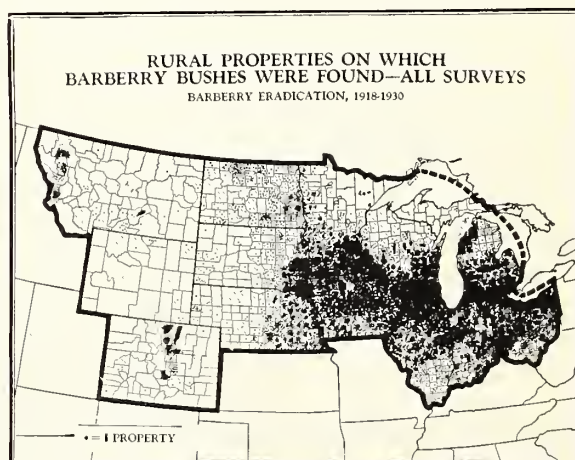
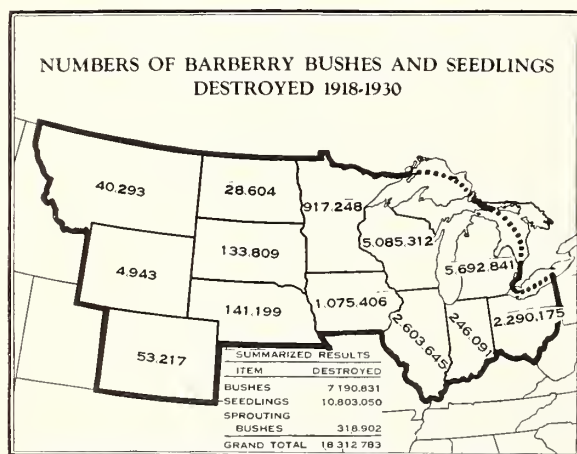
SALTING A BUSH



SPROUTS FROM DUG BUSH

Birds, animals and man chiefly are responsible for the wide distribution of the seeds of common barberries. Every fence row, thicket, pasture or wood is a possible hiding place for these bushes.

Every man, woman and child should consider it his or her duty to look for and report common barberry bushes.



More than 18 million sources of black stem rust
were removed 1918-30

Prepared by the Rust Prevention Association, 300 Lewis Building, Minneapolis, Minn., in co-operation with Bureau of Plant Industry, U. S. Department of Agriculture, Washington, D.C.

LESSON 6 (Optional)

Aim: To organize a campaign to search for common barberry bushes.

Introduction: Why did we decide the common barberry was most to blame for spreading black stem rust? What harm can one barberry bush do? What do you suppose the people did when they first found that the common barberry spread black stem rust? What did we find out the United States Government is doing to eradicate the common barberry bush? Do you suppose you could help them any? How? Would you like to divide yourselves into two groups and see which one can find and report the greatest number of common barberry bushes? You may elect your leaders. What could your groups do to acquaint other people with the common barberry bush and the need for its eradication?

An organization such as this may be formed. Captains choose their groups and choose following helpers:

Newspaper correspondent - Report to papers purpose and activities of groups.

Display committee - Prepare full display of barberry, its results, and how and why it should be destroyed.

This display should be shown in the town or county fair. It might even be taken to the State Fair.

Each group should secure a map of the town or surrounding country (if rural school) and assign a given part to each group to be thoroughly inspected in such a way that no place will be overlooked. A tag showing the exact location of each barberry bush should be filled out and sent to the Leader of Barberry Eradication in your State, in care of your State Agricultural College, or the State Department of Agriculture.

LESSON 7 (Optional)

As a final summary a program on the barberry can be planned by the pupils for their parents, some other school or grade or room,

or any other group that might be interested. The pupils will probably suggest that they display the pictures which they have drawn or collected, and that some of them tell about the way this project was started and how they worked on it from day to day.

The exhibits would include pictures of the following:

- a. Cluster-cups on underside of barberry leaf.
- b. Stem of wheat showing red stage.
- c. Stem of wheat showing black stage.
- d. Common barberry branch.
- e. Japanese barberry branch.
- f. Kernels of wheat, shriveled, due to rust.
- g. Kernels of wheat, normal.
- h. Healthy wheat field.
- i. Field of wheat damaged by rust.

The talks by the pupils might be on the different pictures explaining to the audience what the picture shows, or they might follow the topics in the outline covered. The following is a description of the "purposing, planning, and executing" of a program which one class presented to a class of teachers preparing to teach in rural schools.

When the teacher suggested that they might organize their material into a program, the pupils were very enthusiastic. They first talked about their audiences. For whom would the program be prepared? Since in this school there is a class of teachers preparing to teach in the rural schools, they all agreed that this class should be invited to hear the program. They talked about combining some of the topics. They frequently mentioned the fact that the talks should be connected.

It was finally decided to have one member of the class give a talk that would introduce the subject to the audience. In this introduction they decided that they should tell how they came to study the barberry, where they found the material, and how they correlated it with other subjects. They also decided that it would not be necessary to give all eight topics because some of them would require such short speeches that it might be uninteresting.

It was decided that after the introductory talk the next speaker should tell the audience what kind of a plant the barberry

is, the difference between the common barberry and the Japanese barberry, and the great amount of damage done by the common barberry. In the next talk it was thought best to combine the topics "How the barberry came to the United States" and "Its Uses" for it was really brought here because of its value. Then should come the real story of how the barberry spreads rust. In the final talk, they decided they should tell the best ways of destroying the common barberry, what the State is doing to aid this, and what the people themselves should do.

Committees were chosen for each talk. After they spent some time organizing their material and practicing, their talks were given before the class and the class decided which one from each committee gave his talk the best. The pupil who in the judgment of the class did the best was chosen to give this talk on the program.

As the pupils were preparing their talks they thought that if they had pictures to show, their talks would be clearer to their audience. In art they made drawings of the common and the Japanese barberry, the different stages of black stem rust, and the kernels of wheat which had not been affected by rust and of those that had. The drawings were referred to as the talks were given.

Thus one sees the many opportunities this project offers the teacher to give the pupils training in purposing, planning, and executing. In addition to what was really done in the program described above, the County Agricultural Agent or some leading farmer might have been invited to talk to the pupils. The farmer might have told about his own experience with rust. The pupils might have written invitations to the county agent, either to address them or to attend the program. They might have made posters advertising their program. These and many other suggestions come from this single project to make farm life more interesting and attractive to boys and girls.

In the program described, the following talks were given by the pupils selected by the class.

Introduction

I will tell you how it happened that we studied about the common barberry. We were studying about the States between the

Rocky Mountains and the Mississippi River. We found that wheat was the most important product raised in these States. We also found that the wheat production some years is smaller than in other years. We wanted to know why, so we made a list of all the things we thought caused poor wheat crops. Some of these things are: insects, diseases, too much rain, not enough rain, hail, wind, and frost. We found that wheat's worst enemy is black stem rust and that it is caused by the common barberry.

We will tell you the story of the barberry plant and black stem rust. In art we painted pictures of some of the different stages of black stem rust that we thought would be of interest to you. We looked up the common barberry and black stem rust in reference books. We found most of our information in pamphlets sent out by the State Department of Agriculture, Yearbooks of the Agricultural Departments, encyclopedias, and other agricultural books.

The Common Barberry

The common barberry is largely responsible for the spread of black stem rust to wheat, oats, barley, and rye. It was estimated that in one year rust destroyed more than 180,000,000 bushels of wheat alone, which was enough to have made eleven billion one-pound loaves of bread. Thousands of acres were so badly damaged that they were not harvested.

The common barberry is a tall erect shrub, often ten or twelve feet high. The bark is grayish-brown and the leaves are either green or purple with saw-toothed edges. There are spines in groups of three or more which are dark brown in color and grow along the stem under the leaf clusters. The small red berries hang in long drooping clusters of six or eight berries to the cluster.

The Japanese barberry, which is harmless and should not be destroyed, is a low spreading bush about three or four feet high. The bark is reddish in color. The leaves are green or red, and have smooth edges. The spines are single and the berries are single or in groups of two at the base of the leaf cluster. A few things to remember about the two plants are the difference in shape, coloring of bark, the berries, the leaves, and the spines.

How the Common Barberry Came to the United States

The common barberry has been so interesting to people that something has been known of its history for more than 2000 years. It is not a native of the United States, but is a native of Asia. People from Asia brought it over to Europe and the early colonists from Europe brought it to America.

As the colonists moved westward they took the barberry with them because they used it for sauce, wine, jams, and jellies, and even used the rather tough wood for rake handles and other home-made implements. In the spring the leaves are tender and sour and some people used to eat them for salads.

Many years ago people made their own dyes and ink. From the inner bark of the barberry they made yellow dye. By adding certain materials to this dye they could make green dye. They found that by adding alum to this dye they could make red ink.

Long before the first wire fences were built, people used to separate their different fields with hedges. They liked the barberry best for it had thorns and thick leaves. These kept out both men and animals.

It was a long time before people knew why some years their grain crops would rust and other years they would not. The settlers unknowingly brought to America the common barberry plant, now the worst enemy to the wheat fields.

Stages of Black Stem Rust

There are several stages of black stem rust - the cluster-cup or the spring stage, the red or the summer stage, and the black or the winter stage. The rust starts on the barberry plant in the spring. Yellowish or orange spots are formed on the upper part of the leaf. Many cluster-cups, containing thousands of spring spores are produced on the underside of the barberry leaves. The spores are like little particles of dust and one can see them only under a magnifying glass. You can imagine how small these spores are, for it takes thousands of them to fill one cluster-cup. These cluster-cups break when ripe and the spores are shot out into the air where the wind can catch them. They are carried many miles by the wind. We saw in the local paper not long ago that some of these spores were found on the wing of an airplane ten thousand feet in the air.

These spores may fall on grain or grass plants. They then germinate, the fungus begins to grow and the red stage is the result. The reddish-brown rust spots on grain or grass plants consist of many red-colored spores. These spores are so light that they can be carried a long way by the wind. They may fall on grain or grass plants and germinate in the moisture formed by rain or dew. The fungus then grows into the stem and leaf tissue of the plant, sending out long thread-like tubes which increase until a dense network of threads is formed. They then produce another crop of red spores that break through the skin of the plant, are exposed to the air, and in turn are blown about by the wind. They may fall on grains and grass plants and send their tubes into the plant. More red spores appear and in this way new plants are affected and successive crops are produced.

The entire time from the growing of a plant until the production of a new crop of spores takes only five or six days. The red stage of the rust may repeat about every week or ten days during the growing season as long as the weather is favorable and the plants are still green.

The black stage follows or may even accompany the red stage and is formed usually when the grains are ripe and ready for harvest. The same network of threads that produce the red spores produce the black spores. The red spores are different from the black spores in size, color, and shape. As harvest approaches, some of the spores are red and some black, but later practically all are black. In the Northern States all of the red spores present on grain straw when winter comes die before the next spring.

The black spores do not fly around in the winter but stay on grain straw or old grasses. In the spring they send out long thread-like tubes which produce tiny colorless spores. These spores can not infect grain or grass plants, but only the common barberry. The wind carries them to the barberry where small honey-colored spots are formed on the upper surface of the barberry leaves and cluster-cups on the under side. In these cups are produced thousands of spring spores, or the second stage of black stem rust. From the common barberry the spores are carried by the wind to the growing wheat, oats, barley, and rye. In this way the rust completes its life cycle year after year.

Black Stem Rust and Other Rusts

There are many races of black stem rust. One attacks wheat, another oats, another rye, and so on. The stem rust that attacks wheat is still further divided into many forms which differ in their ability to attack the different kinds of wheat. New rust forms are produced on the barberry leaves by the natural cross-breeding of two old rust forms.

Scientists are constantly producing better and more disease-resistant varieties of grains but, until the barberries have been destroyed, we can not tell when rust forms will appear that will attack the new higher quality grains that are now quite rust-resistant. Barberries must go in order that our future super-varieties of grains may be protected from black stem rust.

The question often is asked whether there are other plants that spread stem rust as the common barberry does. This question has been investigated for many years and it has been shown definitely that the common barberry and some closely related varieties of barberry, which are not commonly grown, are the only plants on which the spring stage of the black stem rust can grow. It is true that there are rusts on many wild and cultivated plants, such as wild roses, willows, goldenrod, asters, wild geranium, knotweed, and a great many others. These rusts, however, are entirely different from black stem rust and have nothing whatever to do with the rust that appears on grain.

Wheat, oats, barley, and rye are attacked by other kinds of rust. These rusts have no relation whatever to the barberry, and therefore will not be prevented by the eradication of this bush. They are generally known as leaf rusts, because they attack only the leaves. All these rusts have a red, or yellow, and a black stage and are very often confused with black stem rust. It is fortunate that the leaf rusts do not harm the grains as much as black stem rust for the spores live through the winter practically everywhere and are usually present in grain fields early in the spring.

How to Destroy the Common Barberry

There are several ways of destroying the common barberry but the best way is to put about 20 pounds of common salt around the base of the bush. This amount of salt when heaped about the crown of a

bush one foot in diameter will kill the underground shoots and roots preventing any possibility of the bush sprouting.

Livestock should be kept away from treated bushes because if they eat too much salt and have not been getting any regularly they are likely to injure themselves. One gallon of kerosene will kill a medium-sized bush slowly. Salt and kerosene will kill other plants as well as the barberry. Use these chemicals carefully or nearby valuable shrubbery may be injured.

There are other methods of reducing rust losses. Some of them may be explained as follows: spring grain should be sown as early as possible so it may ripen ahead of rust. Early ripening wheat often escapes serious injury. If choice of land is possible, wheat should not be sown in low-lying pockets. Air drainage is very important, as it prevents dew and rain water from staying on the plants too long. The longer the moisture stays on the wheat, the greater is the danger of rust. Some varieties of grain are less susceptible to attack by rust than others. Careful selection of grain for seed may help to avoid serious damage by rust. All of these methods will help reduce rust losses.

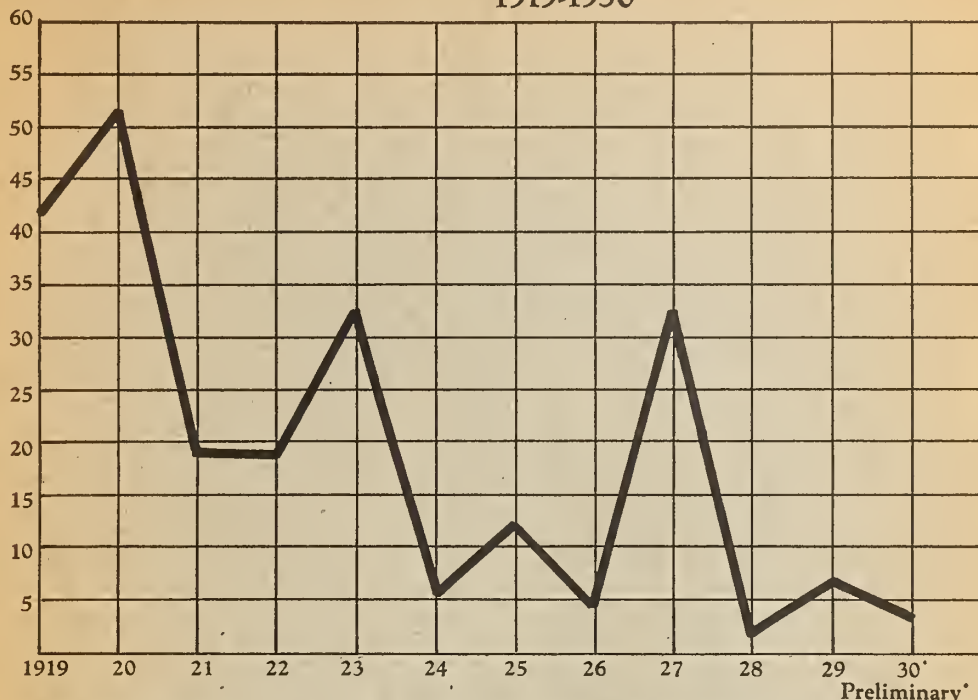
If you ever find a plant that looks like the common barberry send a sample to the county agent or to the Barberry Eradication Office in care of your State Agricultural College or your State Department of Agriculture. The State and Federal Departments of Agriculture send men out each year to find and destroy the common barberry plant. They want a record of every place where common barberry bushes grow, for seeds from the old destroyed bushes may germinate and produce new bushes near where the old ones grew. These locations must be watched very carefully for a number of years after the original bushes are destroyed. Help them find and destroy the common barberry bushes.

Washington, D. C.,
October, 1931.

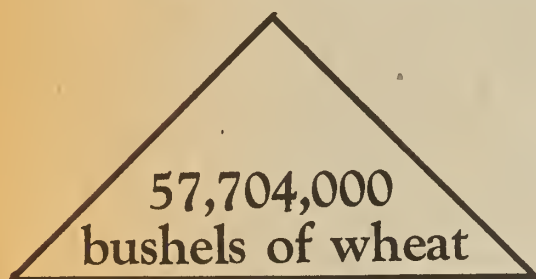
Barberry Eradication Pays

In Millions
of Bushels

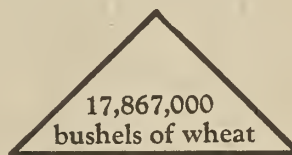
Wheat losses in Barberry Eradication Area
1919-1930



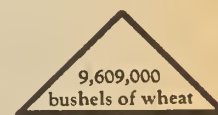
The losses to small grain crops caused by black stem rust have been reduced since the beginning of the barberry eradication campaign in 1918. The breeding of rust-resistant varieties, the use of early maturing varieties, and the sowing of crops early, have aided in this reduction.



Average annual loss
five-year period
1916-1920



Average annual loss
five-year period
1921-1925



Average annual loss
five-year period
1926-1930

Millions of bushels of oats, barley and rye also are
damaged each year by black stem rust

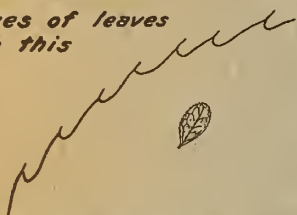
Rust shriveled grain always is discounted

Destroy all Common Barberries—Reduce Losses from Stem Rust.
Receive the Highest Available Price for Grain.

Common Barberry Spreads Black Stem Rust

*When you find
a spiny bush
with-*

*Edges of leaves
like this*



Spines like these



Berries like these



Inner bark yellow



*It is a
Common Barberry
and should be
reported at once*

**Know
Common
Barberry**

Look For It!

*Spread of
Barberries by
birds*

*Birds eat the
berries*



*Carry them to their
roosting places*



*Where they cough
up the seeds*



*From which seedling
bushes grow*



*They in time
bear fruit which
is again carried
farther on*

Look For and Report All Common Barberry Bushes

*To the local Leader of Barberry Eradication, in care of your State Department
of Agriculture or your State Agricultural College*